टी.बी.सी. : **GHSA–T–MTK**

क्रम संख्या

परीक्षण पुस्तिका अनुक्रम

1132110

परीक्षण पुस्तिका
प्रारम्भिक गणित

B

समय : दो घण्टे

पूर्णांक : 100

अ नु दे श

1. परीक्षा प्रारम्भ होने के तुरन्त बाद आप इस परीक्षण पुस्तिका की पड़ताल अवश्य कर लें कि इसमें कोई बिना छपा, फटा या छूटा हुआ पृष्ठ अथवा प्रश्नांश आदि न हो। यदि ऐसा है, तो इसे सही परीक्षण पुस्तिका से बदल लें।

2. कृपया ध्यान रखें कि **OMR** उत्तर-पत्रक में उचित स्थान पर रोल नम्बर और परीक्षण पुस्तिका अनुक्रम **A, B, C** या **D** को ध्यान से एवं बिना किसी चूक या विसंगति के भरने और कूटबद्ध करने की जिम्मेदारी उम्मीदवार की है। किसी भी प्रकार की चूक/विसंगति की स्थिति में उत्तर-पत्रक निरस्त कर दिया जाएगा।

3. इस परीक्षण पुस्तिका पर साथ में दिए गए कोष्ठक में आपको अपना अनुक्रमांक लिखना है। परीक्षण पुस्तिका पर **और कुछ न लिखें।**

4. इस परीक्षण पुस्तिका में **100** प्रश्नांश (प्रश्न) दिए गए हैं। प्रत्येक प्रश्नांश हिन्दी और अंग्रेजी दोनों में छपा है। प्रत्येक प्रश्नांश में चार प्रत्युत्तर (उत्तर) दिए गए हैं। इनमें से एक प्रत्युत्तर को चुन लें, जिसे आप उत्तर-पत्रक पर अंकित करना चाहते हैं। यदि आपको ऐसा लगे कि एक से अधिक प्रत्युत्तर सही हैं, तो उस प्रत्युत्तर को अंकित करें जो आपको सर्वोत्तम लगे। प्रत्येक प्रश्नांश के लिए **केवल एक ही प्रत्युत्तर चुनना है।**

5. आपको अपने सभी प्रत्युत्तर अलग से दिए गए उत्तर-पत्रक पर ही अंकित करने हैं। उत्तर-पत्रक में दिए गए निर्देश देखें।

6. सभी प्रश्नांशों के अंक समान हैं।

7. इससे पहले कि आप परीक्षण पुस्तिका के विभिन्न प्रश्नांशों के प्रत्युत्तर उत्तर-पत्रक पर अंकित करना शुरू करें, आपको प्रवेश प्रमाण-पत्र के साथ प्रेषित अनुदेशों के अनुसार कुछ विवरण उत्तर-पत्रक में देने हैं।

8. आप अपने सभी प्रत्युत्तरों को उत्तर-पत्रक में भरने के बाद तथा परीक्षा के समापन पर **केवल उत्तर-पत्रक** अधीक्षक को सौंप दें। आपको अपने साथ परीक्षण पुस्तिका ले जाने की अनुमति है।

9. कच्चे काम के लिए पत्रक, परीक्षण पुस्तिका के अन्त में संलग्न हैं।

10. गलत उत्तरों के लिए दण्ड :

    वस्तुनिष्ठ प्रश्न-पत्रों में उम्मीदवार द्वारा दिए गए गलत उत्तरों के लिए दण्ड दिया जाएगा।

    (i) प्रत्येक प्रश्न के लिए चार वैकल्पिक उत्तर हैं। उम्मीदवार द्वारा प्रत्येक प्रश्न के लिए दिए गए एक गलत उत्तर के लिए प्रश्न हेतु नियत किए गए अंकों का **एक-तिहाई** दण्ड के रूप में काटा जाएगा।

    (ii) यदि कोई उम्मीदवार एक से अधिक उत्तर देता है, तो इसे गलत उत्तर माना जाएगा, यद्यपि दिए गए उत्तरों में से एक उत्तर सही होता है, फिर भी उस प्रश्न के लिए उपर्युक्तानुसार ही उसी तरह का दण्ड दिया जाएगा।

    (iii) यदि उम्मीदवार द्वारा कोई प्रश्न हल नहीं किया जाता है अर्थात् उम्मीदवार द्वारा उत्तर नहीं दिया जाता है, तो उस प्रश्न के लिए **कोई दण्ड नहीं दिया जाएगा।**

जब तक आपको यह परीक्षण पुस्तिका खोलने को न कहा जाए तब तक न खोलें

Note : English version of the instructions is printed on the back cover of this Booklet.

1. Consider a question and two statements :

   Question :

   Is $3x + 2y$ positive?

   Statement–I : $x^3 = -29 \cdot 8$

   Statement–II : $y^3 = 3x$

   Which one of the following is correct in respect of the question and the statements?

   (a) Statement–I alone is sufficient to answer the question

   (b) Statement–II alone is sufficient to answer the question

   (c) Both Statement–I and Statement–II are together sufficient to answer the question

   (d) Both Statement–I and Statement–II are not sufficient to answer the question

2. Consider a question and two statements :

   Question :

   Does the equation $ax^2 + bx + c = 0$ have real roots of opposite sign?

   Statement–I : The discriminant $D > 0$

   Statement–II : $c/a > 0$

   Which one of the following is correct in respect of the question and the statements?

   (a) Statement–I alone is sufficient to answer the question

   (b) Statement–II alone is sufficient to answer the question

   (c) Both Statement–I and Statement–II are together sufficient to answer the question

   (d) Both Statement–I and Statement–II are not sufficient to answer the question

3. Consider a question and two statements :

   Question :

   Is $a^2 + b^2 + c^2 - ab - bc - ca$ (a, b, c are distinct real numbers) always positive?

   Statement–I : $a > b > c$

   Statement–II : $a + b + c = 0$

   Which one of the following is correct in respect of the question and the statements?

   (a) Statement–I alone is required to answer the question

   (b) Statement–II alone is required to answer the question

   (c) Both Statement–I and Statement–II are required to answer the question

   (d) Neither Statement–I nor Statement–II is required to answer the question

4. Consider a question and two statements :

   Question :

   Is $\dfrac{x^6 + y^6}{x^4 + y^4}$ always greater than $\dfrac{x^4 + y^4}{x^2 + y^2}$ ($x \neq y \neq 0$)?

   Statement–I : $x > y$

   Statement–II : $x^2 + y^2 > 2xy$

   Which one of the following is correct in respect of the question and the statements?

   (a) Statement–I alone is required to answer the question

   (b) Statement–II alone is required to answer the question

   (c) Both Statement–I and Statement–II are required to answer the question

   (d) Neither Statement–I nor Statement–II is required to answer the question

5. How many quadratic equations have the sum of their roots equal to the product of their roots?

(a) Zero

(b) One

(c) Two

(d) Infinitely many

6. If

$$x = \frac{1 - \cos\theta + \sin\theta}{1 + \sin\theta}$$

then what is $\dfrac{\sin\theta + \cos\theta - 1}{\cos\theta}$ equal to?

(a) $\dfrac{1}{x}$

(b) x

(c) $1 + x$

(d) $x - 1$

7. If $\cos(x + y) = 0$ and $\sin(x - y) = \dfrac{1}{2}$, where $x, y \in \left[0, \dfrac{\pi}{2}\right]$, then what is the value of $\cot(2x - y)$?

(a) 0

(b) $\dfrac{1}{2}$

(c) 1

(d) 2

8. What is the minimum value of $\sin^4\theta + \cos^4\theta - 2\sin^2\theta\cos^2\theta$?

(a) 0

(b) 1

(c) 2

(d) Minimum value does not exist

9. If $\cos\theta + \sec\theta - 2 = 0$, where $0 \le \theta < \dfrac{\pi}{2}$, then what is the value of $\cos^4\theta + \sec^4\theta - 2$?

(a) −2

(b) −1

(c) 0

(d) 2

10. If $y = \cos^2 x + \sec^2 x$, where $0 \le x < \dfrac{\pi}{2}$, then which one of the following is correct?

(a) $0 < y < 0 \cdot 5$

(b) $0 \cdot 5 \le y < 1$

(c) $1 \le y < 2$

(d) $y \ge 2$

11. If α and β are the roots of the quadratic equation $x^2 + \alpha x + \beta = 0$, where $\beta \neq 0$, then what is the value of $\alpha - \beta$?

(a) 4

(b) 3

(c) −1

(d) −3

12. A shopkeeper marks the price of an article at ₹200. After allowing a discount of 10%, he still gains 20% on the cost price. What is the cost price of the article?

(a) ₹170

(b) ₹160

(c) ₹150

(d) ₹120

13. A person borrowed ₹9,000 at 7%, ₹12,000 at 8% and ₹15,000 at 9% simple interest per annum. He had to pay ₹50,700 at the end of n years. What is the value of n?

(a) 3

(b) 4

(c) 5

(d) 6

14. Consider the following statements :

1. The sum of the cubes of three consecutive natural numbers is divisible by 9.

2. Every even power of every odd number (> 1) when divided by 8 gives 1 as remainder.

Which of the above statements is/are correct?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

15. What is the number of divisors of 1000 (excluding 1 and 1000)?

(a) 12

(b) 13

(c) 14

(d) 16

16. If the sum of the roots of the equation $x^2 - k^2 x + 30kx - 161x - 64 = 0$ is zero, then what is the difference of the roots?

(a) 15

(b) 16

(c) 17

(d) 18

17. A piece of cloth costs ₹10,000. If a 2 m longer piece of the same cloth is purchased for the same amount, it would cost ₹250 less per metre. What is the original length of the piece of cloth?

(a) 8 m

(b) 10 m

(c) 12 m

(d) 16 m

18. What is the condition that the roots of the equation $ax^2 + bx + c = 0$ are in the ratio $c : 1$?

(a) $b^2 = a(c+1)^2$

(b) $a^2 = b(c+1)^2$

(c) $b^2 = a(c-1)^2$

(d) $ab^2 = (c+1)^2$

19. Two sides of a triangle forming a right angle are $6x^2$ and $(2x^2 - 1)$. If the area of the triangle is 84 square units, then what is the perimeter of the triangle?

(a) 51 units

(b) 53 units

(c) 56 units

(d) 59 units

20. A train X takes 2 hours less than a train Y to cover a distance of 192 km between two cities. Their average speeds differ by 16 km/hr. How long does the faster train take to cover the journey?

(a) 3 hours

(b) 4 hours

(c) 5 hours

(d) 6 hours

21. What is the value of the following?

$$\dfrac{\dfrac{2\sin 68°}{\cos 22°} - \dfrac{2\cot 15°}{5\tan 75°}}{5} - \dfrac{3\tan 20° \tan 40° \tan 45° \tan 50° \tan 70°}{5}$$

(a) −1

(b) 0

(c) 1

(d) 5

22. The perpendicular dropped from a vertex of a right-angled triangle upon the hypotenuse divides it into two segments of lengths 9 units and 16 units respectively. What is the length of the perpendicular?

(a) 6 units

(b) 8 units

(c) 10 units

(d) 12 units

23. If $43^x \times 47^y = (2021)^2$, $x \ne 0$, $y \ne 0$, then what is the value of the following?

$$\dfrac{4xy + x + y}{2xy - x - y}$$

(a) 5

(b) 15

(c) 25

(d) 45

24. Let a, b, c, d be positive integers. If

$$\cfrac{1}{a + \cfrac{1}{b + \cfrac{1}{c + \cfrac{1}{d}}}} = \dfrac{17}{60}$$

then what is the product of a, b, c, d?

(a) 24

(b) 51

(c) 68

(d) 102

25. If $x^2 = 17x + y$ and $y^2 = x + 17y$, $x \ne y$, then what is the value of $\sqrt{x^2 + y^2 + 1}$?

(a) 17

(b) 19

(c) 23

(d) 27

26. What is the least value of n if $194480 + n = m^4$, where m and n are natural numbers?

(a) 1

(b) 2

(c) 3

(d) 4

27. If

$$\dfrac{x - y}{x\sqrt{y} + y\sqrt{x}} = \dfrac{1}{\sqrt{x}} \; ; \; (x > 0, \; y > 0)$$

then what is the value of $\dfrac{x}{y}$?

(a) 1

(b) 2

(c) 4

(d) 8

28. What is the area of the region enclosed by three identical circles (each of radius 4 cm) touching each other?

(a) $\dfrac{8\pi}{3}$ square cm

(b) $\left(16\sqrt{3} - \dfrac{8\pi}{3}\right)$ square cm

(c) $(16\sqrt{3} - 8\pi)$ square cm

(d) $\dfrac{16\pi}{\sqrt{3}}$ square cm

29. A car travels from A to B at a speed of 40 km/hr, travels back from B to A at a speed of 30 km/hr and again goes from A to B at a speed of 60 km/hr. What is the average speed of the car?

(a) $\dfrac{130}{3}$ km/hr

(b) 42 km/hr

(c) 40 km/hr

(d) $\dfrac{125}{3}$ km/hr

30. What is the smallest natural number from the following which must be subtracted from 9410 to make the remaining number a perfect square?

(a) 4

(b) 3

(c) 2

(d) 1

31. What is the ratio of interior angle to exterior angle of a regular polygon of n sides?

(a) n

(b) $\dfrac{n-1}{2}$

(c) $\dfrac{n-2}{2}$

(d) $\dfrac{2(n-2)}{3}$

32. $41^{43} + 43^{43}$ is divisible by

(a) 80

(b) 84

(c) 86

(d) 88

33. If $x = 7 + 4\sqrt{3}$, then what is the value of $\sqrt{x} + \dfrac{1}{\sqrt{x}}$?

(a) 1

(b) 2

(c) 3

(d) 4

34. $4^{61} + 4^{62} + 4^{63} + 4^{64}$ is divisible by

(a) 7

(b) 9

(c) 11

(d) 17

35. Suppose p and q are the LCM and HCF respectively of two positive numbers. If $p : q = 14 : 1$ and $pq = 1134$, then what is the difference between the two numbers?

(a) 27

(b) 35

(c) 45

(d) Cannot be determined due to insufficient data

36. What is the value of the following?

$$\dfrac{(5 \cdot 4)^3 - 0 \cdot 064}{(5 \cdot 4)^2 + 2 \cdot 16 + 0 \cdot 16}$$

(a) 4

(b) 4·4

(c) 5

(d) 5·4

37. A man walks at an average speed of 3 km/hr from his residence and reaches office 40 minutes early. If he walks at an average speed of 2 km/hr, he reaches 40 minutes late. What is the distance between his residence and office?

(a) 6 km

(b) 8 km

(c) 10 km

(d) 12 km

38. What is the value of the following?

$$\dfrac{1}{5\sqrt{4} + 4\sqrt{5}} + \dfrac{1}{6\sqrt{5} + 5\sqrt{6}} + \dfrac{1}{7\sqrt{6} + 6\sqrt{7}} + \dfrac{1}{8\sqrt{7} + 7\sqrt{8}} + \dfrac{1}{9\sqrt{8} + 8\sqrt{9}}$$

(a) $\dfrac{1}{\sqrt{6}}$

(b) $\dfrac{1}{2}$

(c) 1

(d) $\dfrac{1}{6}$

39. If $x = 9999$, then what is the value of the following?

$$\dfrac{4x^3 - x}{(2x + 1)(6x - 3)}$$

(a) 1111

(b) 2222

(c) 3333

(d) 6666

40. If $(x + \sqrt{1 + x^2})(y + \sqrt{1 + y^2}) = 1$, where x and y are real numbers, then what is the value of $(x + y)^2$?

(a) 0

(b) 1

(c) 4

(d) 9

41. $27^5 + 3^{13}$ is divisible by

(a) 8   (b) 10

(c) 12   (d) 21

42. Let $p = 2^{2n+2} + m$ and $q = 2^{4n} - m$ (where n is even natural number). What should be the least value of m such that p as well as q is divisible by 5?

(a) −1   (b) 1

(c) 4   (d) 6

43. If squaring a positive real number x is same as adding 12, then what is x equal to?

(a) 2   (b) 3

(c) 4   (d) 5

44. What is

$$\frac{1}{1+\sqrt{2}} + \frac{1}{\sqrt{2}+\sqrt{3}} + \frac{1}{\sqrt{3}+\sqrt{4}} + \cdots + \frac{1}{\sqrt{2020}+\sqrt{2021}}$$

equal to?

(a) $\sqrt{2020} + 1$

(b) $\sqrt{2021} + 1$

(c) $\sqrt{2020} + \sqrt{2021} - 1$

(d) $\sqrt{2021} - 1$

45. If

$$x + \frac{1}{x} = \frac{5}{2}$$

then what is the value of the following?

$$\frac{5x}{7x^2 - 3x + 7}$$

(a) $\dfrac{3}{7}$ (b) $\dfrac{5}{12}$

(c) $\dfrac{3}{14}$ (d) $\dfrac{10}{29}$

46. If

$$a + b = 2, \quad \frac{1}{a} + \frac{1}{b} = 2$$

then what is the value of $a^3 + b^3$?

(a) 2   (b) 4

(c) 6   (d) 8

47. 8 men or 12 women can do a piece of work in 24 days. In how many days can the work be done by 8 men and 12 women?

(a) 12 days

(b) 18 days

(c) 24 days

(d) Cannot be determined due to insufficient data

48. A car takes p minutes to travel a distance of 350 km with an average speed of u km/hr. Another car takes q minutes to travel the same distance with an average speed of v km/hr. If $u - v = 5$ and $q - p = 140$, then what is the value of u?

(a) 35   (b) 30

(c) 25   (d) 20

49. How many minutes are there in x weeks and x days?

(a) $11520x$ (b) $5760x$

(c) $480x$ (d) $192x$

50. The arithmetic mean and the geometric mean of two positive numbers p and q $(p > q)$ are A and G respectively. Which one of the following is correct?

(a) $A > G$ (b) $G > A$

(c) $A = G$ (d) $A^2 = G$

निम्नलिखि.

लिए व्य.

पिछले वर्ष की

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और 8%

शि, B, D
की तुलना

Direction : Consider the following data for the **two (02)** items that follow :

The table below gives the age-wise population percentage of a city :

Age group	Percentage
Below 30 years	14·00
30–34·99	29·75
35–39·99	26·25
40–44·99	0
45–49·99	18·50
50 years and above	11·50

The number of persons below the age of 40 years is 10·5 lakhs.

51. What is the total population of the city (in lakhs)?

(a) 21

(b) 18

(c) 15

(d) 12

52. If the ratio of taxpayers to other persons in the same age group below 30 years is $1 : 2$, then what is the number of taxpayers (in lakhs) in that age group?

(a) 0·4

(b) 0·7

(c) 0·85

(d) 1·05

Direction : Consider the following data for the **two (02)** items that follow :

The expenditure (in lakhs of rupees) of a company for the years 2011 to 2017 is as under :

Year	Expenditure
2011	13·8
2012	15·4
2013	10·4
2014	13·1
2015	15·8
2016	17·2
2017	19·4

53. How many times the increase in expenditure in a year exceeded by more than 15% as compared to previous year?

(a) 2

(b) 3

(c) 4

(d) 5

54. In which year, the percentage increase in expenditure is maximum as compared to its previous year?

(a) 2012

(b) 2014

(c) 2015

(d) 2017

Direction : Consider the following for the **two (02)** items that follow :

The budget allocations represented in a pie diagram under five different heads A, B, C, D and E are respectively 40%, 18%, 9%, 25% and 8%. The total budget allocation is ₹ 300·4 lakhs.

55. How much less amount is allocated to A and C together as compared to B, D and E together?

(a) ₹ 3·004 lakhs

(b) ₹ 4·005 lakhs

(c) ₹ 6·008 lakhs

(d) ₹ 8·010 lakhs

56. How much amount will be increased on A if the total budget is increased by three times?

(a) ₹360·48 lakhs

(b) ₹300·36 lakhs

(c) ₹240·32 lakhs

(d) ₹180·40 lakhs

Direction : Consider the following for the **four (04)** items that follow :

500 candidates appeared in an examination comprising tests in English, Hindi and Mathematics. 30 candidates failed in English only; 75 failed in Hindi only; 50 failed in Mathematics only; 15 failed in both English and Hindi; 17 failed in both Hindi and Mathematics; 17 failed in both Mathematics and English; 5 failed in all three tests.

57. What is the percentage of candidates who failed in at least two subjects?

(a) 5·4% (b) 6·4%

(c) 6·8% (d) 7·8%

58. What is the percentage of candidates who failed in only one subject?

(a) 28% (b) 31%

(c) 35·8% (d) 38·8%

59. What is the percentage of candidates who failed in at least one subject?

(a) 31% (b) 35·4%

(c) 38·8% (d) 41·5%

60. How many candidates passed in two or more subjects?

(a) 461 (b) 405

(c) 345 (d) 306

61. In a triangle ABC, $AB = 16$ cm, $AC = 12$ cm and AD is the bisector of $\angle A$. If $BD = 4$ cm, then what is CD equal to?

(a) 2 cm (b) 2·5 cm

(c) 3 cm (d) 3·5 cm

62. An equilateral triangle of side x is inscribed in a circle of radius y. Which one of the following is correct?

(a) $2y = x$ (b) $2y = \sqrt{3}\, x$

(c) $\sqrt{3}\, y = 2x$ (d) $\sqrt{3}\, y = x$

63. ABC is a triangle right angled at B. Let D be the midpoint on AC. If $BD = 6\cdot5$ cm, then what is $AB^2 + BC^2$ equal to?

(a) 144 square cm

(b) 169 square cm

(c) 196 square cm

(d) 225 square cm
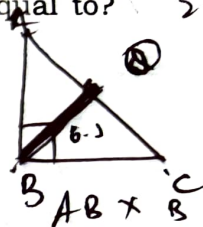
64. Water is trickling out of a completely filled cylindrical tank of height 1 m and diameter 2 m. Every second a spherical droplet of 1 cm radius trickles down from the bottom of the tank. The tank will be emptied in approximately

(a) 280 hours (b) 260 hours

(c) 230 hours (d) 210 hours

65. The length, breadth and height of a cuboid are in the ratio $27 : 8 : 1$. The cuboid is melted and recast into a cube. If p is the surface area of the cuboid and q is the surface area of the cube, then what is p/q equal to?

(a) $\dfrac{247}{108}$ (b) $\dfrac{251}{108}$

(c) $\dfrac{503}{216}$ (d) $\dfrac{505}{216}$

66. In a right triangle *ABC*, *BD* is perpendicular on hypotenuse *AC*. If *AC* = 9 cm and *AD* = 4 cm, then what is *AB* + *BC* approximately equal to?

(a) 12 cm

(b) 12·2 cm

(c) 12·4 cm

(d) 12·6 cm
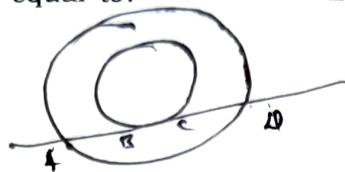
67. In a triangle *ABC*, *AD* is the bisector of ∠*BAC*. If *AB* = 12 cm, *BD* = 10 cm and *DC* = 5 cm, then what is the perimeter of the triangle?

(a) 30 cm

(b) 31 cm

(c) 33 cm

(d) 35 cm

68. What is the radius of the circle inscribed in a triangle whose sides are 4 cm, 7·5 cm and 8·5 cm?

(a) 1·5 cm

(b) 2 cm

(c) 2·5 cm

(d) 3 cm

69. In a shower, 5 cm of rain falls. What is the volume of water that falls on 2 hectare area of land?

(a) 100 cubic metre

(b) 1000 cubic metre

(c) 4000 cubic metre

(d) 10000 cubic metre

70. A bicycle wheel of radius 35 cm makes *n* revolutions in moving 11 km. What is the value of *n*? (Take $\pi = \dfrac{22}{7}$)

(a) 500

(b) 1000

(c) 2500

(d) 5000

71. Consider the following statements :

1. If two chords *AB* and *AC* of a circle are equal, then the centre of the circle lies on the angle bisector of angle *CAB*.

2. If two concentric circles are intersected by a line at *A*, *B*, *C* and *D* respectively, then *AC* = *BD*.

Which of the above statements is/are correct?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2
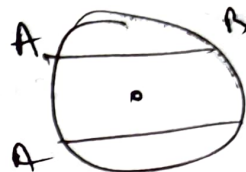
72. A circle of radius 25 cm has a chord of length 48 cm. What is the length of the perpendicular drawn from the centre of the circle to the chord?

(a) 5 cm

(b) 5·5 cm

(c) 6·5 cm

(d) 7 cm
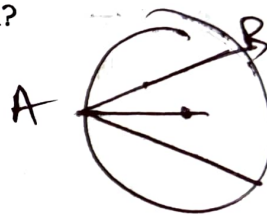
73. The surface area of a cube of length *x* is equal to the surface area of a sphere of radius *y*. Consider the following statements :

1. $2x > 3y$

2. The volume of the cube is greater than the volume of the sphere.

Which of the above statements is/are correct?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

74. The radius and height of a right circular cone are in the ratio $3:7$. If the volume of the cone is 528 cm^3, then what is the height of the cone? (Take $\pi = \frac{22}{7}$)

(a) 3·5 cm   (b) 7·0 cm

(c) 10·5 cm   (d) 14·0 cm

75. A cylindrical pipe has inner diameter of 14 cm. Water flows through it at a rate of 154 litres per minute. What is the speed of water in km/hr? (Take $\pi = \frac{22}{7}$)

(a) 0·5   (b) 0·6

(c) 0·8   (d) 1

76. A spherical ball of lead 6 cm in diameter is melted and recast into three spherical balls. The diameters of the balls are 2 cm, 4 cm and x cm. Which one of the following is correct?

(a) 5 cm < x cm < 5·2 cm

(b) 5·2 cm < x cm < 5·4 cm

(c) 5·4 cm < x cm < 5·6 cm

(d) 5·6 cm < x cm < 5·8 cm

77. A rectangle of length 10 units and breadth 8 units is split into two squares each of area x square units and two rectangles each of area y square units. Consider the following statements :

1. y is always greater than x.

2. y can be 15 square units.

Which of the above statements is/are correct?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

78. A square sheet is formed by joining n identical square sheets of same size. If the length of the diagonal of the bigger square sheet so formed is m, then what is the side length of a smaller square sheet?

(a) $\dfrac{m}{\sqrt{n}}$ (b) $\dfrac{m}{2\sqrt{n}}$

(c) $\dfrac{m}{\sqrt{2n}}$ (d) $\dfrac{\sqrt{2}\,m}{\sqrt{n}}$

79. A rectangular sheet is of length x and breadth y. If p is the volume of the cylinder formed by rolling the sheet along its breadth and q is the volume of the cylinder formed by rolling the sheet along its length, and $q = 2p$, then which one of the following is correct?

(a) $x = y$

(b) $2x = 3y$

(c) $x = 2y$

(d) $3x = 4y$

80. A tall cylindrical container with circular base of radius 18 cm contains a good quantity of water. Metal balls each of radius 0·9 cm are immersed in it. How many balls are required to raise the water level by 3 cm?

(a) 100

(b) 500

(c) 1000

(d) 1500

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81. If A, B, C are acute angles and
$$\sin(B + C - A) = \cos(C + A - B) = \tan(A + B - C) = 1$$
then what is $(A + B + C)$ equal to?

(a) 90°

(b) 120°

(c) 135°

(d) 150°

82. If A, B, C, D are the angles of a cyclic quadrilateral, then what is the value of the following?
$$\sin\left(\frac{A + C}{2}\right) + \sin\left(\frac{B + D}{2}\right)$$

(a) 2

(b) 1

(c) 0

(d) −1

83. An aeroplane is observed to be approaching the airport. It is at a distance of 10 km from the point of observation on the ground and makes an angle of elevation θ. If the aeroplane is at a height of 8 km above the ground, then which one of the following is correct?

(a) $0 < \theta < 30°$

(b) $30° < \theta < 45°$

(c) $45° < \theta < 60°$

(d) $60° < \theta < 90°$
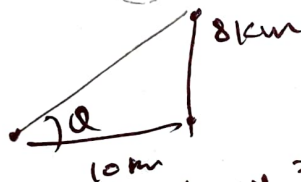
84. The angle of elevation of the top of a tower of height x metre from a point on the ground is found to be 60°. By going y metre away from that point, it becomes 30°. Which one of the following relations is correct?

(a) $x = y$

(b) $2x = 3y$

(c) $2x = \sqrt{3}\, y$

(d) $2y = \sqrt{3}\, x$
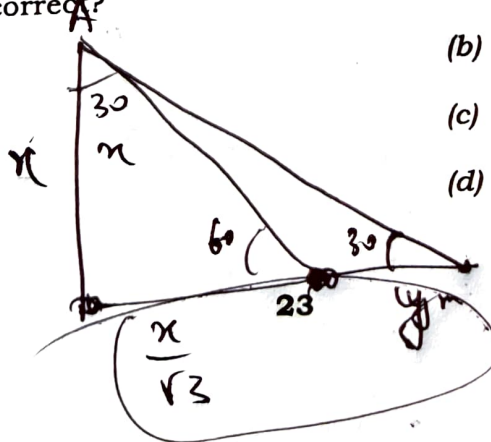
85. What is
$$(\sec^2 \alpha + \tan\alpha \cdot \tan\beta - \tan^2 \alpha)^2$$
$$+ (\tan\alpha - \tan\beta)^2 - \sec^2 \alpha \cdot \sec^2 \beta$$
equal to?

(a) −1

(b) 0

(c) 1

(d) 2

86. If $\tan\theta + \sec\theta = 3$, then what is the value of $3\tan\theta + 9\sec\theta$?

(a) 15

(b) 17

(c) 19

(d) 21

87. Consider the following :

1. $\sqrt{\sec^2 \theta + \csc^2 \theta} = \tan\theta + \cot\theta$,
   where $0 < \theta < 90°$

2. $\sqrt{\tan^2 \theta + \cot^2 \theta + 4} = \sec\theta + \csc\theta$,
   where $0 < \theta < 90°$

Which of the above is/are an identity/identities?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

[P.T.O.

88. What is the length of the chord of a unit circle which subtends an angle 2θ at the centre, where $\theta < 45°$?

(a) $\sin 2\theta$

(b) $\cos 2\theta$

(c) $2\sin\theta$

(d) $2\cos\theta$

89. If $\tan^2\theta + 3\sec\theta - 9 = 0$, where $0 < \theta < 90°$, then what is the value of $12\cot^2\theta + 3\mathrm{cosec}\theta$?

(a) $(\sqrt{3}+1)^2$

(b) $(\sqrt{3}+2)^2$
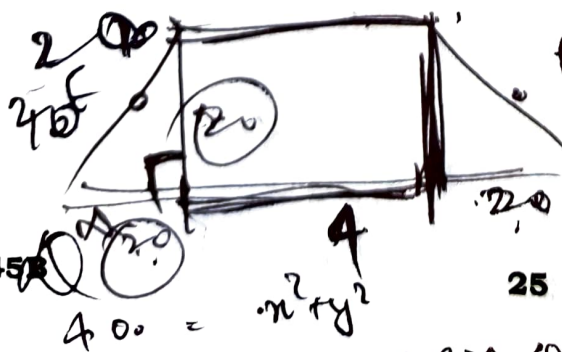
(c) $(2\sqrt{3}+1)^2$

(d) $(3\sqrt{3}+1)^2$

90. If

$$\frac{\cos\theta}{\mathrm{cosec}\theta + 1} + \frac{\cos\theta}{\mathrm{cosec}\theta - 1} = 2$$

where $0 < \theta < 90°$, then what is the value of $\sin^4\theta + \cos^4\theta$?

(a) 2

(b) 1

(c) $\frac{1}{2}$

(d) $\frac{1}{4}$

91. An equilateral triangular sheet is formed by joining 9 equilateral triangular sheets each of area $9\sqrt{3}$ cm^2. What is the height of the bigger triangular sheet?

(a) $9\sqrt{3}$ cm

(b) 18 cm

(c) $18\sqrt{3}$ cm

(d) 27 cm
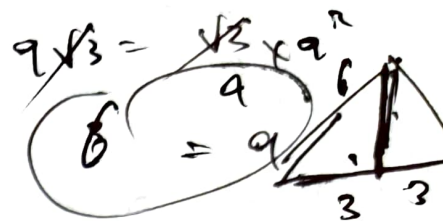
92. A farmland is in the shape of a rhombus. The perimeter of the land is 100 m and the length of one of the diagonals is 40 m. The land is divided into four equal parts. What is the area of each part?

(a) 150 square metre

(b) 225 square metre

(c) 300 square metre

(d) 450 square metre
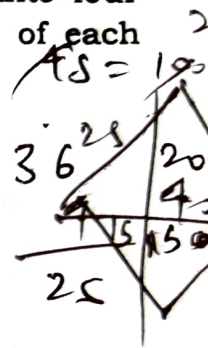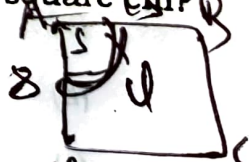
93. ABCD is a trapezium in which AB is parallel to DC. Let E and F be the midpoints on AD and BC respectively. If $EF = 10$ cm and $AB - DC = 4$ cm, then what is the value of $AB \times DC$?

(a) 84 square cm

(b) 96 square cm

(c) 100 square cm

(d) 108 square cm

94. ABCD is a parallelogram with $AB = 15$ cm and $AD = 8$ cm. If θ is the acute angle between AB and AD, then what is the area of the parallelogram in square cm?

(a) $60\sin\theta$

(b) $120\sin\theta$

(c) $60\cos\theta$

(d) $120\cos\theta$

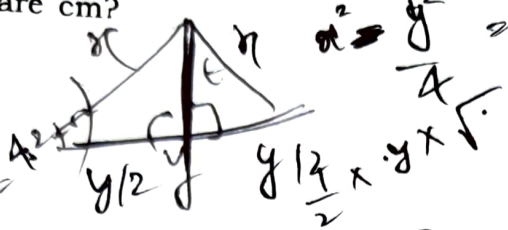...the perimeter of an isosceles right triangle is $4(2+\sqrt{2})$ cm, then what is its area in square cm?

(a) 8

(b) 12

(c) 16

(d) 24

96. The diagonal of a square is $12\sqrt{2}$ cm and the area of an equilateral triangle is $64\sqrt{3}$ square cm. Which of the following statements is/are correct?

1. The square and the triangle have the same perimeter.

2. Four times the area of the square is equal to $3\sqrt{3}$ times the area of the triangle.
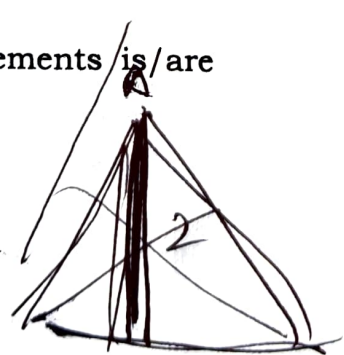
Select the correct answer using the code given below.

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

97. Consider the following statements :

1. The sum of any two sides of a triangle is less than twice the median drawn to the third side.

2. The perimeter of a triangle is greater than the sum of the three medians.
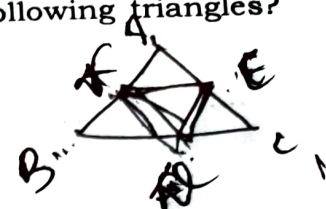
Which of the above statements is/are correct?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

98. Let D, E and F be the midpoints of the sides BC, CA and AB respectively of a triangle ABC. Triangle DEF is congruent to which of the following triangles?
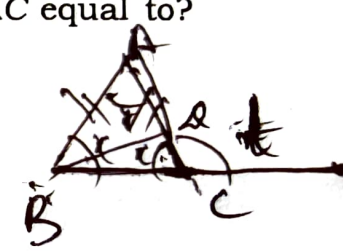
1. AEF

2. FBD

3. EDC

Select the correct answer using the code given below.

(a) $\sqrt{3}$ only

(b) 2 and 3 only

(c) 3 only

(d) 1, 2 and 3

99. In a triangle ABC, $AB = AC$ and BC is produced to D such that $\angle ACD = x$, then what is $\angle BAC$ equal to?

(a) $2x - 90°$

(b) $2x - 180°$

(c) $180° - 2x$

(d) $\dfrac{x}{2}$

100. ABC is a triangle right angled at B with $AC = 2BC$. If $\angle A = x$, then what is $\angle C$ equal to?

(a) $\dfrac{x}{2}$

(b) $2x$

(c) $\sqrt{2}\,x$

(d) $\sqrt{3}\,x$

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